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Testing an Earth-Science Aid

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Need for the Aid

Making a collection is not always considered an erudite use of laboratory time. It has been said that study of rocks, for example, entails a good deal more than discovering that a specific specimen can be assigned a specific name. This is freely admitted to be true, but this writer has discovered that assigning the proper name to a specimen demands a more careful and memorable examination of discriminating details of rock types, for example, and that it leads to a useful familiarity with variations of a single rock type.

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It is said also that such a limited variety of rocks is available locally that rock collecting in Iowa is futile, and yet we live in a glacial drift area where road cuts and similar exposures bring a good variety to light. In addition, vacation travelers often carry home rock specimens to share with others having a similar interest.

At any rate, a fairly recent attempt at rock collecting was made in order to fulfill a class assignment. A key was furnished by the instructor and its use explained. Nevertheless, problems arose in following it. It seemed simple to those accustomed to it, but nearly meaningless to uninitiated newcomers. In pondering this difficulty it became evident that children could hardly be expected to master a key that presented such problems for "experienced" teachers. Therefore, simplification seemed in order. This simplification was brought about by construction of a visual aid that incorporated the information on the original outline-type key.

Construction of the Aid

It was noted that in progressing from point to point on the original key each new step presented two or more choices unless the final answer were reached. Thus the idea of ever-expanding variety of choices brought to mind an ever-expanding circle—or circles of ever-greater dimension. This, then, was the form given the new visual aid—seven plywood discs, each three inches wider than the one before, and all rotating on a single post. The key points were marked on the successive discs in appropriate positions starting at the center and working outward. Choices for each step were arranged side-by-side on the same "level." If all these choices were rejected, one left that level and proceeded outward to the next step, or level, and its choices. These choices were again arranged side-by-side on the same level for easy comparison and examination. By continuing in this manner, one progressed outward until the appropriate answer was determined.

Method of Use

The discs move separately for a purpose. In progressing outward each level will have one suitable key point, one of the discriminating details, until the answer level is reached. By correctly rotating the discs all these separate pertinent details can be lined up along one radius, thus giving at a quick glance a list of the characteristics of the specimen being examined.

On the other hand, if the discs are arranged at start position, as indicated by a peg through a series of holes that are suitably lined up, the key makes several generalizations evident:

1. Some rocks are alike except for one characteristic, e.g., limestone and marble, granite and syenite, gneiss and schist, sandstone and quartzite, slate and shale.
2. Fewer rock-types are fine-grained than are coarse-grained.
3. Few rock types are banded.
4. Few rock types react to hydrochloric acid.
5. Few rock types have mineral crystals of equal size.
6. Few rock types are glassy.
7. Fewer rock types are light in color than are dark.

These generalizations help to give a clearer overall view of rock varieties and their relationships, and to put them into perspective.

Interpretation of vocabulary in the rock key also presented serious problems. Gradations made it difficult to be certain what was meant by "fine-grained," "light-colored," "black," "rough," and so on. For example, dark gray and light black can intergrade so closely as to be indistinguishable.

Visual rock key supplemented with vocabulary board and collection of rock specimens.

Very coarse and very fine grains are easily distinguished, but the intervening gradations can be very similar. In order to alleviate this problem, a vocabulary board was assembled by collecting rock chips having the various characteristics and labeling them. Thus a student could see several samples of "fine-grained," "light-colored," "black," and "rough" rocks and get visual and tactile experience that would clarify meanings of these descriptive words.

Value of the Aid—A Test

In the classroom these aids were received enthusiastically by third-grade students and aroused a good deal of interest in rock-collecting. Accuracy of identification proved surprisingly high, so it was surmised that the aids had some value. Consequently a test was set up involving two classrooms. One selected to act as a control group studied a rock unit as usual; the other selected to act as the experimental group used the visual aids. Identical evaluation materials were administered by the regular classroom teachers. The evaluation consisted of nine written questions, six rock identifications, and a rock collection. The teachers were gracious and helpful, as were the students. However, it was readily discernible that carrying on a good test is not as simple as passing out materials and tallying results.

1. Teachers were unable to use the unit at the same time. Therefore, weather conditions were not similar for collecting and for promoting interest.
2. Tests did not follow the teaching at identical time intervals. The control group was tested immediately following conclusion of the unit. The experimental group

Third-graders of Williamsburg School System examine keys and collection.

was tested several months after the unit was concluded. Therefore, immediate recall and delayed recall are to be reconciled.

3. Teacher background was varied; a science major with a B.S. who formerly taught high school science and has rock-collecting as a hobby taught the control group. The experimental group was taught by a teacher with normal liberal arts training for a B.A. in education—but with a fine science interest and enthusiasm.
4. A sixth-grade class was used for the control group, while a fifth-grade class was used for the experimental group.
5. The teacher of the control group realized before starting the unit that an evaluation of this type would follow, while the teacher of the experimental group used the aid in normal teacher sharing before a test was conceived. Obviously the many inequalities keep this test from accurately demonstrating whether the rock wheel has value in the classroom or not.

Results of Test

The following table briefly sums up the data compiled from the two testing situations.

Table 1

	Test Data Compiled	
	Experimental Group	Control Group
Students participating	21	17
Rock types collected and correctly identified per pupil	10.3	8.6
Percentage of written test items correct	51%	77%
Percentage of identification test items correct	37%	61%

Although for reasons noted above no definite conclusions can be drawn from these results, it is possible to note the following points:

1. Interest was high in both groups; in one case because the aid was being used and in the other case possibly because the students accepted competition with those using the device.
2. Both groups scored higher on the written items than on the identifications, indicating that the latter were the more difficult.
3. The margin between groups was less in the identification test, suggesting that the aid was of more value in teaching this difficult facet of a rock unit.
4. This finding is further borne out by the fact that the experimental group showed a smaller margin between their scores in each area than did the control group.
5. This possibility of usefulness in teaching difficult material warrants a further test.

Improved Plan for Retesting

Now that experience has given some insight into carrying on a useful investigation, the test should be revised before being continued.

Several of the problems could be resolved by securing a single teacher who would let one section of the class use the aid and another section of equal ability study in the way normally used. In this way differences in teacher background, time of teaching, type of recall demanded, age of children, and classroom atmosphere could all be eliminated. Instruction would vary little except for use of the device.

Small size of the group tested also

limits the usefulness of the test. This limitation could be overcome by securing several teachers to cooperate as described above or by keeping records from a single instructor for a period of years. The former method would seem to be preferable if it were feasible, since it would not limit results to influence of a single personality. If valuable, the key should be usable for the general population of teachers. In addition it would save time to do testing simultaneously.

As a further improvement, it would seem a wise idea to change the form of the identification section of pupil evaluation from naming the specimen to matching the specimen to a given name. When the percentage of correct responses is as low as recorded here, the group is being over-challenged and may lose interest if frustration continues.

To summarize, the testing of this earth-science aid has had the value of arousing interest, as is common with any new technique. It has been valuable as an instrument in broadening teacher background, and has brought deeper understanding and appreciation of the problem of learning how to teach most effectively. It has shown in another way that the research seminars conducted by our universities make an important contribution to the university program by helping to develop critical study of teaching by teachers.

RECOGNITION PROGRAMS FOR SECONDARY TEACHERS

The Academy will sponsor several recognition programs for secondary science and mathematics teachers in cooperation with other organizations in Iowa. The Iowa Section of the American Association of Physics Teachers, the Iowa OBTA Program as organized by the National Association of Biology Teachers, and the Iowa Chapter of the Mathematical Association of America are the other organizations directly involved.

The contact persons for each of the programs now functioning are as follows:

Biology: Paul Tweeten, State Department of Public Instruction, Des Moines

Chemistry: William Oelke, Cornell College, Mt. Vernon

Mathematics: Charles Lindsay, Coe College, Cedar Rapids

Physics: Lester Earls, Iowa State University, Ames

All high school principals in Iowa have been notified of the four programs. All of the above listed chairmen are now receiving nominations for the honors. A complete file of nominees is maintained by each group, which means that a teacher may need only to be renominated on a given year without the need for the supporting information.

The teachers honored in 1967 were as follows:

Biology: Mr. Daryl Stiers
Chemistry: Mr. Frank Starr
Mathematics: Miss Helen Kane
Physics: Mr. William Kacena, Jr.

Members of the Academy may wish to nominate teachers for the 1968 honor. Please send such names and your recommendation to the appropriate state chairman.